P-ISSN: 1996-983X
E-ISSN: 2960-1908

مجلة المخطط والتنمية

Journal of planner and development

Vol 31 Issue 1 2026/4/7

Reviewing of Accuracy Assessment classification for Land use Map by Using Remote Sensing and GIS Techniques

Hamed Abdullah Abbas hamed.abbas2312@coeng.uobaghdad.edu.iq

Hussein Sabah Jaber hussein.alhassani@coeng.uobaghdad.edu.iq

University of Baghdad / College of Engineering/Surveying Engineering Department

Abstract

This paper presents a detailed overview of the historical development and current state of accuracy assessment in land cover mapping, specifically within the field of Remote Sensing of the Environment over the past two decades. It underscores the pivotal role accuracy assessment plays in refining land cover mapping techniques, stressing the significance of high-quality reference data, sampling methodologies, and accuracy metrics. Experience shows that urban expansion causes degradation of agricultural land, vegetation and water bodies. This urban sprawl contributes to many urban environmental problems such as poor air quality, rising temperatures and poor water quality.

Accuracy assessment techniques have undergone enhancements to bolster their scientific robustness, resulting in a more stringent process. The collective body of research and practical applications has propelled accuracy assessment to a mature state.

This research aims to use the best approach to estimate and evaluate the accuracy of land use map classification based on the use of high-resolution satellite images.

Despite significant advancements, there remain avenues for improvement. This study identifies the necessity for improved documentation of accuracy assessment methodologies to bolster research endeavors. Moreover, as technological capabilities progress, new challenges emerge, such as the imperative to tackle the heightened capacity for extensive spatial and intensive temporal mapping of land cover. Addressing these challenges mandates the development of enhanced methodologies to effectively cope with them.

Also, This paper focused on a literature review of satellite image classification techniques and their methods.

We conclude from all this that the need to classify satellite images is essential to extract land use data to solve environmental problems and improve living conditions.

Keywords: Remote Sensing(RS), Geographic Information Systems (GIS), Support Vector Machine Algorithm (SVM) , Maximum Likelihood Algorithm (MLC) , Accuracy Assessment

مجلة المخطط والتنمية

Journal of planner and development

P-ISSN: 1996-983X

E-ISSN: 2960-1908

Vol 31 Issue 1 2026/4/7

مراجعة تصنيف تقييم الدقة لخرائط استخدامات الأراضي باستخدام تقنيات الاستشعار عن بعد ونظم المعلومات الجغرافية

حامد عبدالله عباس hamed.abbas2312@coeng.uobaghdad.edu.iq

حسين صباح جابر hussein.alhassani@coeng.uobaghdad.edu.iq

جامعة بغداد/ كلية الهندسة/ قسم هندسة المساحة

المستخلص

يقدم هذا البحث نظرة عامة مفصلة عن التطور التاريخي والحالة الحالية لتقييم الدقة في رسم خرائط الغطاء الأرضي، وخاصة في مجال الاستشعار عن بعد للبيئة على مدى العقدين الماضيين. وتؤكد على الدور المحوري الذي يلعبه تقييم الدقة في تحسين تقنيات رسم خرائط الغطاء الأرضي، مع التأكيد على أهمية البيانات المرجعية عالية الجودة، ومنهجيات أخذ العينات، ومقاييس الدقة.

تظهر التجربة أن التوسع الحضري يسبب تدهور الأراضي الزراعية والنباتات والمسطحات المائية. يساعد هذا الانتشار الحضري في العديد من المشاكل البيئية الحضرية مثل انخفاض جودة الهواء، وارتفاع درجات الحرارة وسوء جودة المياه.

لقد خضعت تقنيات تقييم الدقة لتحسينات لتعزيز قوتها العلمية، مما أدى إلى عملية أكثر صرامة. لقد دفع العمل الجماعي للأبحاث والتطبيقات العملية تقييم الدقة إلى حالة ناضجة.

يهدف هذا البحث إلى استخدام أفضل نهج لتقديروتقييم دقة تصنيف خرائط استخدام الأراضي بناءً على استخدام صورالاقمارالصناعية عالية الدقة

وعلى الرغم من التقدم الكبير، لا تزال هناك طرق للتحسين. تحدد هذه الدراسة ضرورة تحسين توثيق منهجيات تقييم الدقة لدعم جهود البحث. وعلاوة على ذلك، مع تقدم القدرات التكنولوجية، تظهر تحديات جديدة، مثل ضرورة معالجة القدرة المتزايدة على رسم خرائط مكانية مكثفة وزمنية مكثفة للغطاء الأرضي. إن معالجة هذه التحديات تتطلب تطوير منهجيات محسنة للتعامل معها بشكل فعال.

كما ركز هذا البحث على مراجعة الأدبيات حول تقنيات تصنيف صور الأقمار الصناعية وطرقها.

نستنتج من كل هذا ان الحاجة لتصنيف صورالاقمارالصناعية ضرورية لاستخراج بيانات استخدام الاراضي لحل مشاكل البيئة وتحسين الظروف المعيشية.

الكلمات المفتاحية : الاستشعارعن بعد، نظم المعلومات الجغرافية، خوارزمية الة دعم المتجه،خوارزمية الاحتمالية العظمى ، تقييم الدقة

P-ISSN: 1996-983X
E-ISSN: 2960-1908
مجلة المخطط والتنمية
Journal of planner and development
Vol 31 Issue 1 2026/4/7

1. Introduction

The classification of satellite images includes grouping image Pixel values into meaningful categories. Methods for classifying satellite images can be divided into three groups. (1) manual,(2) hybrid, and(3). Automatic.

All strategies have benefits and drawbacks of their own. Most of the classification methods for satellite images come into the third group. The classification of satellite images requires selecting the most suitable

classification method based on the requirements. Figure (1.1) illustrates the hierarchy of classification methods for satellite images.

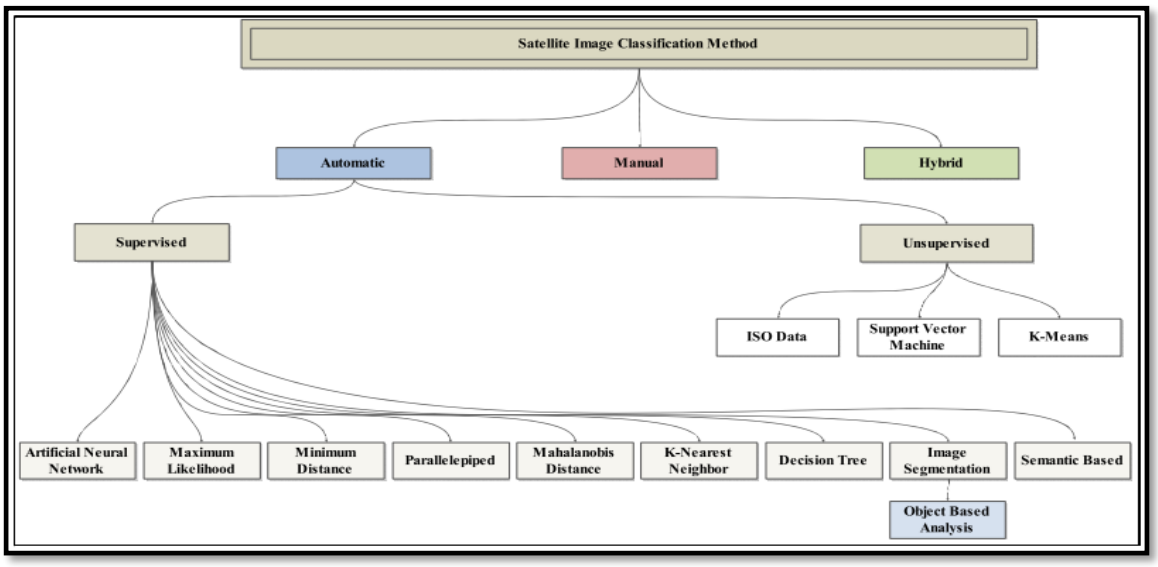

Figure 1.1. Satellite image classification methods hierarchy.(Abburu & Babu Golla, 2015)

The automated method of classification of satellite images is further categorized into two groups: (1) supervised and (2) unsupervised classification methods. The current research study is a satellite image analysis with supervised classification methods and techniques based on MLC and unsupervised based on SVM. This paper also compares different researchers and comparative findings on methods of classification of satellite images.(Abburu & Babu Golla, 2015)

In general, there are two types of classification techniques: parametric and non-parametric algorithms. Parametric classification algorithms assume that the data for each class is normally distributed. The (MLC) is the most commonly used parametric classification algorithm, which generates decision surfaces according to covariance and the mean of each class. Non-parametric methodologies, on the other

hand, such as SVM classification, do not make any Supposition about the statistical nature of data and are a new technique to add to the category of image processing techniques.(Taati et al., 2015).

P-ISSN: 1996-983X
E-ISSN: 2960-1908

مجلة المخطط والتنمية

Journal of planner and development

Vol 31 Issue 1 2026/4/7

The widely used Maximum Likelihood Classifier (MLC) is a prime example of a classification algorithm. This algorithm assigns each Pixel to a class based on the probability that Pixel belongs to that specific class. However, such suggestions about normal distribution may be limited and may not provide satisfactory results in some conditions. There were also classification algorithms that used non-parametric techniques, such as (SVM), with no assumptions about probability distribution, aiming to find the best-separating boundaries between classes and pixels. (Jonsson, 2015).

2. Problem Statement

because of shifts in landscape and anthropogenic changes as an outcome of economic and growth and population expansion that affected on land use and land cover in rural areas,and due to rapid urbanization that lead to rise additional request for natural resources.

The need to classify satellite images to extract LULC data are essential to analyse the processes of environment problems and to improve living conditions. Hence, to solve these problems, it can be used the integration of geospatial techniques for instance remote sensing as well as GIS for classification of satellite images to create LULC maps because of have been widely applied and well known as a powerful as well as effective techniques.

3. Research Objectives

The overall aim of this study is to classify the satellite images and the land use statement using different classification Techniques and algorithms. This objective will be obtain from the following sub-objectives:

(1) To investigate the study area, and identify the LC/LU classes.
(2) To perform based classification of satellite image by different algorithms.
(3) To produce the thematic map of study area.
(4) To assess the expected result from collecting ground truth references based on accuracy indices.

4. Review of the Classifications Image and Its Methods

(Uca Avci et al., 2011) Investigated a suitable technique for general landcover mapping. The tests were carried out on SPOT 5 multispectral data from Istanbul, Turkey. Iso data and MLC techniques of Pixel Based were compared with feature extraction and nearest neighbor approaches to feature extraction. The findings showed that the efficiency of the condition-based approach is higher than that of the others. The advantage of condition-based categorization over other approaches

P-ISSN: 1996-983X
E-ISSN: 2960-1908
مجلة المخطط والتنمية
Journal of planner and development
Vol 31 Issue 1 2026/4/7

is considered to be the use of direct specifications for object criteria in class definitions. Overall, iso data classifications had an accuracy of 75%; maximum likelihood classifications had an accuracy of 82 %. Feature Extraction classifications had an accuracy of 88 %, and nearest neighbor classifications had an accuracy of 85%.

Tsai et al. (2011) investigated the mapping and quantification of newly constructed buildings in Accra, Ghana, between 2002 and 2010. Using QuickBird's very high-resolution satellite imagery, they compared two semi-automated feature detection methods: post-classification comparison and bi-temporal layer stack classification. The bi-temporal layer stack approach proved superior due to its ability to minimize uncertainty by highlighting differences between buildings and their surroundings. Additionally, a spectral/spatial contextual approach, implemented using Feature Analyst, outperformed a true object-based feature delineation approach (ENVI Feature Extraction) by more accurately delineating individual buildings of various sizes. The study concluded that a semi-automated, object-based detection approach, followed by manual editing, offers a reliable and efficient solution for identifying and counting new building objects. This approach combines automated detection's efficiency with human intervention's precision, resulting in accurate and robust results.

(Abd, 2013) applied hyperspectral satellite imagery, and Google Earth was provided for analysis. To create the thematic map of the UPM University campus located in West Malaysia, Selangor state. The study area was categorized into nine land use/cover classes: Clear Water, Lake, Soil, Roads, Building R-roof, Building Roof, Building B-roof, Grass, and Tree, using two classification strategies: SVM for Feature Extraction classification and MLC for pixel classification. The findings showed that SVM is more reliable than Maximum likelihood MLC, with an overall accuracy of 98.23 % for SVM and 90.48 % for MLC, respectively.

(Abd & Alnajjar, 2013) used satellite imagery to describe the LU/LC change in vegetation and urban areas in the South of Johor in Malaysia. Landsat TM for the year 1995 and Landsat ETM+ for the year 2011 were used. Supervised Classification and MLC have been achieved to categorize the images into different land cover classes. The study area is categorized into five classes: urban area, vegetative, water bodies, and barren land unknown (cloud); analysis of shift identification indicates that the built-up area has been increased by 3%, while the vegetative area has been reduced by 12%. The accuracy obtained is around 90.11% and 94.14%, respectively.

P-ISSN: 1996-983X
E-ISSN: 2960-1908
مجلة المخطط والتنمية
Journal of planner and development
Vol 31 Issue 1 2026/4/7

(Byun et al., 2013) showed an effective segmentation technique for high-resolution pan-sharpened imagery using GeoEye-1 image as well as QuickBird image, respectively. The study focused on dense urban areas in Hobart, Australia, and Daejeon, Korea, utilizing both spatial and spectral data. A multispectral nonlinear edge detection technique was employed, incorporating smoothing and isolation of multispectral edges to guide seed selection and image segmentation. Initial seeds were automatically chosen, followed by image segmentation using an adjusted seeded region growing technique. Based on visual evaluation and quantifiable comparison evaluation, experimental findings on two multispectral satellite data demonstrated that the proposed method outperformed prior segmentation strategies.

(Tilahun , A. , & Teferie , B. , 2014) Focused on assessing the accuracy of land use and land cover classification in Kilite Awulalo, Tigray State, Ethiopia. They utilized Landsat-8 OLI_TIRS imagery from 2014 and ArcGIS 10.1 software for analysis. Supervised classification was used to categorize the images into various land use and land cover types, including agricultural land, settlement land, grazing land, forest land, bush land, water bodies, and bare/stony land. To evaluate the accuracy of the classification, the researchers generated 100 random points in ArcGIS, which were then converted into KML format for visualization in Google Earth. Each of these random points' classification was verified using imagery from Google Earth, which served as ground truth data.

(Jonsson, 2015) used high spatial resolution from the SPOT5 satellite to evaluate the classification approach that is best fit to keep up to date with new land use in the Amazonas, Brazil. There are three approaches put to the test; 2 are Pixels-based, and one is Feature Extraction. Concerning the former, they are SVM with Radial Basis Function (RBF) kernel in addition to MLC. Also, the latter has been segmented with the Multi-Resolution Segmentation (MRS), also k-NN. Each of the three methods will generate two categorized maps: one with the three original wavebands (green, red, and NIR) and another with a six-dimensional feature space that includes the three original wavebands and three texture derivations. Just two met the appropriate overall accuracy requirement of 85 %. Both were SVM (86.8 %) and kNN (86.2 %), the latter of which included texture analysis. None of the classifications consisting solely of the three initial bands met this limit. The contrast texture derivation from the green and near-infrared bands and an entropy texture derivation from the red band were the three most appropriate texture derivations. When these three texture derivatives were combined with the initial bands, the categories became much more distinct.

P-ISSN: 1996-983X
E-ISSN: 2960-1908
مجلة المخطط والتنمية
Journal of planner and development
Vol 31 Issue 1 2026/4/7

The texture analyses with GLCM separated classes more in the feature space than when just utilizing the original red, green, and NIR bands.

(Aburas et al., 2015) applied Two Landsat satellite image TM to extract NDVI values between 1990 and 2010. The study aimed to detect the LU/LC change in Seremban City, which is the largest district and the capital of the Negeri Sembilan State. MLC was utilized for the classification of Four classes of (LU/LC) namely built-up areas, barren land, water bodies, and vegetation. NDVI values are computed first when defining the NDVI index using the Natural Breaks (Jenks) approach. Results showed that regions lacking vegetation increased from 3.55 % to 7.25 % in 2010, such as water sources, built-up areas, and desert fields. The dense vegetation area also declined from 78.57 % to 65.44 %, reflecting the need for new urban strategies to protect vegetation regions throughout urban and economic development. Accuracy assessment, according to classifications, is 87% and 88%, respectively. Kappa values of 0.85 and 0.87 were obtained for 1990 and 2010 NDVI categorized maps, respectively

(Taati et al., 2015) researched to generate LU classification using an MLC and SVM classification in the Qazvin region, Iran, using the Landsat 5 satellite TM image. The required corrections were implemented to the images in the pre-processing phase. The effectiveness of the two algorithms was evaluated using overall accuracy and the Kappa index. The assessment outcome confirmed that SVM, with an overall accuracy of 86.67 % and a kappa index of 0.82, has greater precision than MLC in LU mapping.

(Sophia S. Rwanga & J. M. Ndambuki ,2017) highlighted the significance of integrating remote sensing and GIS techniques for generating accurate land-use/land-cover maps. They emphasized the use of supervised classification, particularly the Non-Parametric Rule, in achieving this goal. The study achieved an overall classification accuracy of 81.7% with kappa coefficient of 0.722, indicating a high level of agreement between the classified image and ground truth data land-use/land-cover classes identified, including agriculture, water bodies, built-up areas, mixed forest, shrubs, and barren/bare land, providing valuable insights into the composition of the study area. With agriculture comprising the largest portion at 65.0%, followed by built-up areas at 18.3%, the distribution of land cover types can inform land management strategies and urban planning initiatives.

(Kaplan & Avdan, 2017) are applied an approach combining a Pixel-based index, and a Feature Extraction technique has been operated in a satellite image from Sentinel-2 with a resolution of ten m. The approach uses image segmentation. It also makes use of indices like (NDWI), which are used to extract water bodies. Two study areas, one mountainous and the other urban in Macedonia, were chosen

P-ISSN: 1996-983X
E-ISSN: 2960-1908
مجلة المخطط والتنمية
Journal of planner and development
Vol 31 Issue 1 2026/4/7

because they have distinct characteristics. The outcomes of the NDWI have been enhanced by a kappa coefficient of more than 0.5. The overall accuracy of the Feature Extraction categorization was greater than 90% in the first region, with a kappa coefficient of 0.88, but the kappa coefficient was 0.9 in the second area

(K. Nivedita Priyadarshini et al., 2018) focused on land use and land cover (LU/LC) classification in the Paonta Sahib region of Himachal Pradesh, using Sentinel-2A satellite data. The study employed different algorithms, both supervised (such as MD, ML, Parallelepiped, and SVM) and unsupervised (such as ISO Data and K-Means), to classify the land cover types in the region. Based on the results, it seems that the Maximum Likelihood classification method achieved the highest accuracy among the applied methods. This indicates that it's the most suitable method for performing LU/LC classification using Sentinel-2A data in the Paonta Sahib region. Accuracy assessment is crucial for evaluating the reliability of the classification results.

(Miranda et al., 2018) indicated that high-resolution satellite images can be classified for land cover (LC) using supervised techniques. The land cover map of Indonesia's central Java region. Sentinel-2 has obtained the satellite image, which was collected through USGS. For supervised classification, Arc GIS 10.5 was used to categorize image objects. To create a land cover map of the four groups (urban, barren land, water, and forest), he describes the main groups in the mapping of the RSNI-1 National Standardization Body of Indonesia. This research established a supervised classification with MLC, where the land cover classification was correctly assigned to 4 categories, with overall accuracy equal to 1, while the kappa index is equal to 0.48966. While the evaluation yielded a low Kappa accuracy value, it also exhibited a high overall accuracy. This high accuracy can be attributed to the comprehensive supervised experiment conducted during the classification stage.

(Roy et al., 2018)studied the output of per-pixel classification comparatively to Feature Extraction image analysis for mapping mango orchards in Uttar Pradesh's Sitapur district (UP). High-resolution IRS-Resourcesat-2 LISS IV imagery was used. The Supervised Maximum Likelihood algorithm was used for pixel-based classification, and the Segmentation Lambda Schedule was used for Feature Extraction classification. Following the collection of ground truth data, an accuracy analysis showed 65 % and 92 %, respectively, which increased to 96 % after visual editing of the latter. According to the findings of the study, feature extraction classification is the state-of-the-art method for high-accuracy mapping of orchards.

P-ISSN: 1996-983X
E-ISSN: 2960-1908

مجلة المخطط والتنمية

Journal of planner and development

Vol 31 Issue 1 2026/4/7

(M. Majidi Nezhad & A. Heydari et al., 2019) The study focused on enhancing the accuracy of land cover classification in the Mediterranean climate region, specifically in Rome, Italy, using satellite imagery from Sentinel-2A provided by the European Space Agency (ESA). Two classification algorithms, ML and SVM, were employed for the classification process using ENVI software. The study aimed to identify five land cover classes: urban, forest, water, agriculture, and empty land. The results showed that the ML method, when applied to Sentinel-2A images, achieved higher overall accuracy and Kappa coefficient compared to the SVM method. This superiority can be attributed to several factors: Methodological Enhancements: The ML method was enhanced through additional steps such as Sieve Classes, Clump Classes, and Majority/Minority Analysis, aimed at increasing accuracy and kappa coefficient for Image Quality and Training Sample Sites.

(M. Matin Saddiqi et al., 2021) demonstrated that the application of remote sensing combined with Geographic Information Systems (GIS) in environmental studies is invaluable across various domains, including land use and land cover change detection, environmental assessment, landslide mitigation, and flood hazard forecasting and assessment. Change detection, a common use of remote sensing and GIS, involves comparing imagery from different time periods to identify and quantify changes in land cover and land use over time. Both passive and active remote sensing techniques were employed for change detection analysis.

(Nadia A. Aziz & Imzahim A. Alwan,2021) studied classify land cover in the Al-Hawizeh marsh located on the Iraq-Iran border using Sentinel-2B satellite imagery by the European Space Agency (ESA), with a spatial resolution of 10 meters. The study utilized three classification methods – Maximum Likelihood Classification (MLC), Artificial Neural Networks (ANN), and Support Vector Machines (SVM) – to classify land cover into six distinct classes: marsh vegetation, shallow water marsh, deep water marsh, agricultural area, barren soil, and urban area. The primary objective was to assess the accuracy of these methods in differentiating these land cover types. The analysis utilized Sentinel 2B imagery as input data. The study found that when applied to Sentinel 2B images, the MLC method outperformed both ANN and SVM methods in terms of overall accuracy and Kappa coefficient. This suggests that MLC, in this specific context, proved to be the most effective classification technique for the given land cover classes and data sources. Specifically, the overall accuracy values for MLC, ANN, and SVM methods were declared as 85.32%, 70.64%, and 77.01%, respectively. This suggests that for the classification of marshland areas in the AlHawizeh region,

P-ISSN: 1996-983X
E-ISSN: 2960-1908
مجلة المخطط والتنمية
Journal of planner and development
Vol 31 Issue 1 2026/4/7

the MLC method proves to be the most effective among the three tested algorithms in this study area.

(Fernando, P., et al., 2022) used approach comprehensive and effective for vegetation and water body detection in a tropical agricultural area like southeastern Mexico. Using Sentinel-2 satellite images along with spectral indices, and employing machine learning algorithms such as support vector machine, random forest, and classification and regression trees can indeed enhance the analysis. The division of the study period into two seasons each year seems logical, as it likely captures significant changes in vegetation and water dynamics characteristic of tropical regions. Additionally, identifying various land use categories, including water bodies, land in recovery, urban areas, sandy areas, and tropical rainforests, provides valuable insight into the landscape composition. Overall accuracy and kappa index scores are impressive, indicating high performance across the board. The support vector machine and kappa index stand out with the highest accuracy, suggesting its effectiveness in accurately classifying land cover types and minimizing false positives.

(Ali &Jaber,2020).Concern over water supply has increased recently, especially in arid and semi-arid areas. Iraq's Sea of Najaf serves as an example of a place with little water availability. As a vital water source for local populations, this lake is susceptible to climate change and other stressors. Accurate surface water mapping is imperative for effective water resource management. While a potent tool for detecting surface water, remote sensing can struggle to differentiate between water bodies like lakes, rivers, and wetlands. The wider spectral range of Sentinel-2B provides more information about surface water, which can be helpful for distinguishing between different types of water bodies

(Islami, F. A ., et al., 2022) conducted a thorough examination of land use and land cover (LULC) changes in Sadar Watershed, Mojokerto, East Java, Indonesia, over the span of a decade. Achieving accurate classification of LULC from remote sensing imagery is indeed challenging but crucial for understanding the dynamics of land use change, especially in regions experiencing rapid population growth like Mojokerto Regency. Thus, the approach applied in the study, wherein Google Earth was utilized for identifying ground truth and ArcGIS for cover-age of random points, appears rather sound. That is true to the extent that the division into five categories appropriately covers the main types of land use in the region. It is also revealed from the Overall Accuracy and Kappa Coefficient for each reported year that classification results are accurate enough and consistent for the entire year. The quantitative analysis of the study proved that high overall accuracy and Kappa coefficient show that the classification is true to the actual distribution of distinct

P-ISSN: 1996-983X
E-ISSN: 2960-1908
مجلة المخطط والتنمية
Journal of planner and development
Vol 31 Issue 1 2026/4/7

land use types in the study area. In sum, the present study has made a significant contribution to identifying the trend of land use change in Mojokerto Regency, which may be beneficial in formulating policies and plans in line with urban planning, environmental management and sustainable development in the examined area.

(Alberto Concejal, 2024) he underlined how earth observation has made it possible for evaluation without the need to visit the site as it only requires the acquisition of both terrestrial and atmospheric information. Since sentinel-2 satellite has wide spectral band which includes the visible and Non- visible light giving detailed description of the land features such as vegetation, water body, urban areas and so on, it is greatly useful in classification of the land use.

(Fahad &Dibs,2020,Yousef& Jaber,2023, Dibs &Al-Ansari,2023,). In pixel-based classification, the algorithm compares the spectral signature of each pixel to a set of pre-defined spectral classes or a statistical model, such as a Gaussian distribution. Classification models also useful for analyzing changes in satellite images and identifying patterns of changes over time

(Jing Qian, 2007) the study was carried out with an intention of comparing the different classifications made on the remote sensing data in an arid environment. The search involved comparing Pixel based image classifiers including the Maximum likelihood algorithm with a Feature Extraction image classifier using a Landsat ETM+ image to identify the appropriate arid zone image classification technique. Both techniques were assessed for accuracy using ground control data which were extracted from high-resolution satellite data, aerial photographs and field data. The finding indicated that the Feature Extraction technique yielded 89 % accuracy for the kappa index. 87, while 71 % favour a kappa index of 0. Indeed, 66 for the Pixel-based approach.

Mostafa et al. (2014) conducted a comparative study of two classification methods using high-resolution satellite imagery acquired from the IKONOS satellite. The study focused on four distinct test areas within Assiut governorate, Egypt, each representing different planning requirements. The first method employed conventional pixel-based image analysis, utilizing ERDAS V.9.2 software for processing and classification. The second method involved object-oriented image classification, implemented using eCognition Developer software V.8.0. The accuracy of each method was evaluated using overall accuracy and kappa coefficient derived from confusion matrices. The study's findings demonstrated that object-based image analysis outperformed pixel-based analysis, yielding more accurate results. Furthermore, the study revealed a positive correlation between the level of planning in an area and

P-ISSN: 1996-983X
E-ISSN: 2960-1908
مجلة المخطط والتنمية
Journal of planner and development
Vol 31 Issue 1 2026/4/7

the accuracy of the classification results, indicating that areas with more detailed planning tend to produce more precise classifications.

(Sertel & Alganci, 2016)showed that The impact of forest fire in the region was determined by comparing pre and post situation in Izmir, Turkey. SPOT-6 images are defined depending on Pixel and Feature Extraction classification algorithms to reliably distinguish the boundaries of burned areas. The current findings demonstrate that relying solely on normalized difference vegetation index (NDVI) thresholds to identify burn marks is inadequate for Feature Extraction classification. However, developing a rule set that involved mean brightness numbers of near-infrared and red bands and mean NDVI values for all segments significantly enhanced classification accuracy. According to the assessment findings, A map of the burned area was created using a Feature Extraction with a kappa value of 0.9322 and a pixel-based method with a kappa value of 0.7433.

(Yousef & Jaber,2023).The course of the river may traverse through urbanized regions, agricultural fields, forests, and natural reserves. These distinct land cover types pose challenges when utilizing remote sensing data to monitor and estimate the surface area of Sea of Najaf. Furthermore, the study area is subject to both natural and anthropogenic factors that can impact the dynamics of the Lake. Natural elements, such as seasonal fluctuations, precipitation patterns, and geological processes, interact with human activities, including irrigation, dam construction, urbanisation, and deforestation. Comprehending and quantifying these influences on the lake's surface area are essential for effective water resource management and environmental conservation endeavours

(Dervisoglu et al., 2020) researched that Wet lands greatly benefit from remote sensing concepts and techniques, according to studies. The object was to determine the coastline of the wetlands. Sentinel 2 satellite data is used to investigate Duden Lake's coastline throughout all four seasons using pixel-based techniques. The techniques are investigated and assessed for their applicability in evaluating the shallow wetland coastline. The classification accuracy of pixel-based and feature-extraction-based images is assessed. The accuracy evaluation applied to the classification results was greater than 90% in each method.

(Maarez & Shareef,2023) Sentinel-2 satellite imagery was used to assess the rise in water levels in the Sea of Najaf region in many studies

P-ISSN: 1996-983X
E-ISSN: 2960-1908

مجلة المخطط والتنمية

Journal of planner and development

Vol 31 Issue 1 2026/4/7

'A summary the proposed studies''						
Nam.	Researcher's name	Year of research	The technology uesd	Cognitive addition	The satellite used	Search area
1	Uca Avci	2011	Iso, MLC	The showed that the efficiency of the condition-based approach is higher than of the others.	SPOT 5	Turkey
2	Tsai	2011	post-classification comparison and bi-temporal layer stack classification	The feature analysis approach outperformed the feature extraction approach	QuickBird	Ghana
3	Abd	2013	MLC , SVM	SVM is more reliable than MLC	Landsat TM	Malaysia
4	Abd & Alnajjar	2013	MLC	The accuracy of the Landsat ETM+ satellite is better than Landsat TM satellite	Landsat ETM+, Landsat TM	Malaysia
5	Byun	2013	image segmentation	This method is superior and gives good results.	GeoEye-1, QuickBird	Australia, Korea
6	Tilahun , A. & Teferie , B.	2014	Supervised classification	A number of random points can be used to achieve the desired accuracy.	Landsat-8 OLI_TIRS	Ethiopia
7	Jonsson	2015	SVM,MLC,k-NN	Both SVM,K-NN the accuracy requirements.	SPOT5	Brazil
8	Aburas	2015	MLC	Increasing urban areas and decreasing vegetation cover	Landsat TM	Negeri
9	Taati	2015	MLC,SVM	SVM is more reliable than MLC	Landsat 5 TM	Iran
10	Kaplan & Avdan	2017	The approach image segmentation,the Feature Extraction categorization	The overall accuracy of the Feature Extraction categorization was greater than 90%	Sentinel-2	Macedonia
11	K. Nivedita Priyadarshini	2018	employed different algorithms	the MLC method achieved the highest accuracy	Sentinel-2A	Pradesh
12	Miranda	2018	MLC	The overall accuracy is high, unlike the low accuracy of the Kappa indicator.	Sentinel-2	Indonesia
13	Roy	2018	MLC,Feature Extraction classification	Feature extraction classification is preferred for high-resolution mapping of orchards.	IRS-Resourcesat-2 LISS IV	Pradesh
14	M. Majidi Nezhad & A. Heydari	2019	MLC , SVM	MLC Produces higher overall accuracy.	Sentinel-2A	Italy
15	Nadia A. Aziz & Imzahim A. Alwan	2021	MLC,SVM,ANN	MLC is more reliable	Sentinel-2B	Iraq-Iran border
16	Fernando, P	2022	SVM, random forest, and classification and regression trees	SVM is more reliable	Sentinel-2	Mexico
17	Ali &Jaber	2020	remote sensing	Accurate surface water mapping is imperative for effective water resource management	Sentinel-2B	Iraq
18	Alberto Concejal	2024	remote sensing	The Sentinel-2 satellite is particularly valuable for collecting data without the need for field visits.	sentinel-2	

P-ISSN: 1996-983X
E-ISSN: 2960-1908

مجلة المخطط والتنمية

Journal of planner and development

Vol 31 Issue 1 2026/4/7

5. Conclusions

By understanding land use patterns and trends at different scales, it can better plan and monitor development activities to minimize negative impacts on the environment while maximizing economic and social benefits. This information is essential for making informed decisions and implementing effective strategies for sustainable development.

The integration of RS with GIS techniques for the classification of satellite images to extract LU/LC maps is very important because these techniques have saved time, cost, and effort.

The literature review has shown mixed results, as there are different methods for analyzing satellite imagery. Current research is exploring whether its theoretical advantages can be applied to a particular form of imagery to obtain more reliable results. Recent research has been stimulated by this ongoing debate. These methods have advantages and disadvantages in mapping and analyzing changes in satellite imagery. The performance of each technique is compared in this study to determine the best approach for this type of application. This information is of great importance to managers in strategic planning and future research on land quality and modeling agricultural land use changes.

6. Recommendations

1) It is possible to draw LU/LC map more efficiently using high-resolution images and more accurate analysis of LU/LC classifications using high-resolution image downloads such as Satellite Worldview, Quick Bird, and IKONOS.

2) Use SVM algorithm as an effective algorithm for extracting LU/LC maps to create a geodatabase by integrating RS and GIS due to its high accuracy and greater precision in the research field.

3) Conduct more studies using high-resolution thermal or radar images to gain more information.

P-ISSN: 1996-983X
E-ISSN: 2960-1908

مجلة المخطط والتنمية

Journal of planner and development

Vol 31 Issue 1 2026/4/7

4) Plan future work to implement deep learning techniques to enhance the efficiency and quality of the methodology. It would increase the overall accuracy of the technique by adding more data samples to the training and test sets. The dataset could also be improved by improving the studied classes to include more diverse terrain detection.

5) It is important to continue comparing the advantages of each of these methods with different types of LU/LC and different types of images. Comparing how different techniques perform when classifying forest/non-forest areas or urban landscapes and LU/LC classification in different climate zones are just examples of what should be seen if one approach can be better defined. However, the applications of this study are endless with problems and issues related to LU/LC analysis and change detection.

6)To improve the accuracy of land use classification assessment, it is necessary to implement remote sensing methodologies that use satellite imagery to monitor and accurately quantify land cover and land use (LU/LC) changes.

P-ISSN: 1996-983X
E-ISSN: 2960-1908

مجلة المخطط والتنمية

Journal of planner and development

Vol 31 Issue 1 2026/4/7

REFERENCES

1. Abburu, S., & Babu Golla, S. (2015). Satellite Image Classification Methods and Techniques: A Review. International Journal of Computer Applications, 119(8), 20–25.
2. Abd, H. A. A.-R. (2013). Feature extraction and based pixel classification for estimation the land cover thematic map using hyperspectral data. The Land, 3(3).
3. Abd, H. A. A., & Alnajjar, H. A. (2013). Maximum Likelihood for Land-Use / Land-Cover Mapping and Change Detection Using Landsat Satellite Images: A Case Study " South Of Johor ." International Journal of Computer & Electronics Research, 03(6), 26–33.
4. Aburas, M. M., Abdullah, S. H., Ramli, M. F., & Ash'aari, Z. H. (2015). Measuring Land Cover Change in Seremban, Malaysia Using NDVI Index. Procedia Environmental Sciences, 30, 238–243.
5. Ali, A. H., & Jaber, H. S. (2020). Monitoring degradation of wetland areas using satellite imagery and geographic information system techniques. Iraqi Journal of Agricultural Sciences, 51(5).
6. Byun, Y. G., Han, Y. K., & Chae, T. B. (2013). A multispectral image segmentation approach for object-based image classification of high resolution satellite imagery. KSCE Journal of Civil Engineering, 17(2), 486–497.
7. Dibs, H., Jaber, H. S., & Al-Ansari, N. (2023). Multi-Fusion algorithms for Detecting Land Surface Pattern Changes Using Multi-High Spatial Resolution Images and Remote Sensing Analysis. Emerging Science Journal, 7(4), 1215-1231.
8. Dervisoglu, A., Bilgilioglu, B. B., & Yagmur, N. (2020). Comparison of Pixel-Based and Object-Based Classification Methods in Determination of Wetland Coastline. International Journal of Environment and Geoinformatics, 7(2), 213–220.
9. Fahad, K. H., Hussein, S., & Dibs, H. (2020). Spatial-temporal analysis of land use and land cover change detection using remote sensing and GIS techniques. In IOP conference series: materials science and engineering (Vol. 671, No. 1, p. 012046). IOP Publishing.
10. Fernando Pech - May , Raúl Aquino - Santos, German Rios-Toledo , Juan Pablo Francisco Posadas - Durán 2022 Jun 23 ; 22 (13) : 4729 . doi: 10.3390/s22134729.

P-ISSN: 1996-983X
E-ISSN: 2960-1908

مجلة المخطط والتنمية

Journal of planner and development

Vol 31 Issue 1 2026/4/7

11. Islami F. A., S. D. Tarigan, E. D. Wahjunie and B. D. Dasanto , 2022 2nd ISeNREM 2021 IOP Conf. Series: Earth and Environmental Science 950 (2022) 012091 IOP Publishing doi : 10.1088 / 1755 - 1315/950/1/012091 1Accuracy Assessment of Land Use Change Analysis Using Google **Earth in Sadar Watershed Mojokerto Regenc.**
12. Jing Qian, Q. Z. and Q. H. (2007). Comparison of pixel-based and object-oriented classification methods for extracting built-up areas in arid zone. ISPRS Workshop on Updating Geo-Spatial Databases with Imagery & the 5th ISPRS Workshop on DMGISs, 8(August), 163–171.
13. Jonsson, L. (2015). Evaluation of pixel based and object based classification methods for land cover mapping with high spatial resolution satellite imagery , in the Amazonas , Brazil . Student Thesis Series INES; (2015), 366, 70.
14. Kaplan, G., & Avdan, U. (2017). Object-based water body extraction model using Sentinel-2 satellite imagery. European Journal of Remote Sensing, 50(1), 137–143.
15. Miranda, E., Mutiara, A. B., Ernastuti, & Wibowo, W. C. (2018). Classification of Land Cover from Sentinel-2 Imagery Using Supervised Classification Technique (Preliminary Study). Proceedings of 2018 International Conference on Information Management and Technology, ICIMTech 2018, September, 69–74.
16. Majidi Nezhad M., A. Heydari, L. Fusilli, G. Laneve (2019) Proceedings of the 4th World Congress on Civil , Structural , and Environmental Engineering (CSEE'19) Rome, Italy – April, 2019 Paper No. ICEPTP 158 DOI : 10.11159 / iceptp 19.158 ICEPTP 158-1 Land Cover Classification by using Sentinel-2 Images.
17. Maarez, H. G., & Shareef, M. A. (2023). Utilization of Geographic Information System for hydrological analyses: A case study of Karbala province, Iraq. Iraqi Journal of Science, 4118-4130.
18. Matin saddiqi M., recep kaan dereli, sojan mathew. Irish national hydrolog conference 2021: proceedings - 1 - 03 - accuracy assessment of land use land cover change detection in burdur watershed, turkey : comparing active and passive remote sensing.
19. Mostafa, F. A., Mostafa, Y. G., & Yousef, M. A. (2014). the Optimal Method for Classifying High Resolution Satellite Images in Egypt Environment. JES. Journal of Engineering Sciences, 42(4), 1106–1121.
20. Nadia A. Aziz and Imzahim A. Alwan , (2021) An Accuracy Analysis Comparison of Supervised Classification Methods for Mapping Land Cover Using Sentinel-2 Images in the Al Hawizeh Marsh Area ,Southern Iraq Geomatics

and Environmental Engineering,Vol.15 No.1 (2021): Article Published : Feb 4, 2021.

21. Nivedita K. priyadarshini,minakshi kumar,s.Abdul rahaman, s.nitheshnirmal the international archives of the photogrammetry, remote sensing and spatial information sciences , volume xlii-5, 2018 isprstcv mid-term symposium "geospatial technology – pixel to people", 20november 2018 , dehradun , indiaa comparative study of advanced land use/lan cover classification algorithms using sentinel – 2 data.

22. Roy, S., More, R., Kimothi, M. M., Mamatha, S., Vyas, S. P., & Ray, S. S. (2018). Comparative analysis of object based and pixel based classification for mapping of mango orchards in Sitapur district of Uttar Pradesh. Journal of Geomatics, 12(1), 69–76.
23. Sophia S. Rwanga, J. M. Ndambuki (2017). Accuracy Assessment of Land Use/ Land Cover Classification Using Remote Sensing and GIS. International Journal of Geosciences Vol.08 No.04 (2017) Article ID: 75926,12, pages10.4236/ijg.2017.84033.

24. Sertel, E., & Alganci, U. (2016). Comparison of pixel and object-based classification for burned area mapping using SPOT-6 images. Geomatics, Natural Hazards and Risk, 7(4), 1198–1206.
25. Taati, A., Sarmadian, F., Mousavi, A., Pour, C. T. H., & Shahir, A. H. E. (2015). Land use classification using support vector machine and maximum likelihood algorithms by landsat 5 TM images. Walailak Journal of Science and Technology, 12(8), 681–687.
26. Tsai, Y. H., Stow, D., & Weeks, J. (2011). Comparison of object-based image analysis approaches to mapping new buildings in Accra, Ghana using multi-temporal QuickBird satellite imagery. Remote Sensing, 3(12), 2707–2726.
27. Tilahun Abineh, & Teferie Bogale . (2015) Accuracy Assessment of Land Use Land Cover Classification using Google Earth . American Journal of Environmental Protection . Vol. 4 , No. 4 , 2015 , pp. 193-198. doi: 10.11648/j.ajep.20150404.14.

28. Uca Avci, Z. D., Karaman, M., Ozelkan, E., & Papila, I. (2011). A comparison of pixel-based and object-based classification methods, a case study: Istanbul, Turkey. 34th International Symposium on Remote Sensing of Environment - The GEOSS Era: Towards Operational Environmental Monitoring, April.
29. Yousef, O. A. R., & Jaber, H. S. (2023). Studying the Environmental Changes Using Remote Sensing and GIS. Iraqi Journal of Science,4605-4616.